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PROGRAM SEARCH DISPLAY DEVICE  
[Bangumi kensaku hyoji sochi]

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[Claim 1] A program search display device of a TV receiver that receives and plays back TV signals being transmitted as superimposed signals carrying service information of TV programs, comprising (1) a service information storing means that isolates/stores the service information attached to said TV programs, (2) viewing priority sequence storing means that establishes/stores the viewer preference and viewing priority order of said TV programs, (3) viewing program data storing means that compares and matches the service information stored in the service information storing means, viewer's preference stored in the viewing priority sequence storing means, and viewing priority sequence and stores the image data of the TV programs conforming the viewing preference and viewing priority order in addition to the service information, (3) window size creation means that creates different sizes of program guide windows according to the image data and service information of TV programs stored in the viewing program data memory means, (4) program window display means that displays plural program guide windows comprising different display sizes created by the window size creation means onto the TV receiver screen, and (5) program selection means that selects a program from plural program guide windows displayed by the program window display means.

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[Claim 2] A program search display device of a TV receiver that receives and plays back TV signals being transmitted as superimposed signals carrying service information of TV programs, comprising (1) a station selection means that selects the viewing program from the TV signals, (2) viewing priority sequence storing means that establishes and stores the viewer preference and view priority order of said TV programs, (3) program information reading means that reads off the program information from the program information recording medium to which the program information containing at least the image data and service information of the TV programs are stored, (4) viewing program data storing means that compares and matches the program information read from the program information reading means and viewer preference and viewing priority stored in the viewing priority order storing means and stores the program information matching the viewing preference and viewing priority order, image data of the TV programs conforming the viewing preferences and viewing priority order, (5) window size creation means that creates different sizes of program guide windows according to the image data and service information of TV programs stored in the viewing program data memory means, (6) program window display means that displays plural program guide windows of different display sizes created by the window size creation means onto the TV receiver screen, and (7) program selection means that selects a program from plural program guide windows displayed by the program window display means whereby said station

selection means selects the station for the specific viewing program selected from the TV signals by the program selection means.

[Claim 3] Program search display device according to Claim 1 or 2, wherein the sizes of program guide windows created by said screen size creation means are sequentially reduced in the descending order of viewing priority of TV programs, whereby the program window display means reproduces and displays the windows on the TV receiver screen in the order of smaller size to the larger size of program guide windows positioned to provide three dimensional visual effects.

[Claim 4] Program search display device according to Claim 1 or 2, wherein the program window display means divides program guide windows into plural categories and reproduces and displays the windows on the TV receiver screen according to the program categories.

[Claim 5] Program search display device according to Claim 3 or 4, wherein by selecting a lower priority program after searching the viewing program from plural program guide windows reproduced and displayed on the TV receiver screen by the program selection means, the programs having the priorities higher than the specified program are erased from the screen, allowing the selected program and programs having the priorities lower than the specified program to sequentially replacing the erased windows with applicable expanded window sizes.

[Claim 6] Program search display apparatus according to Claim 3, 4, or 5, wherein for re-searching a program having a higher priority after specifying a program having a lower viewing priority using the program selection means, the sizes of currently displayed windows having lower priority levels are reduced and moved on the screen so as to re-display the programs having higher viewing priority levels than the currently specified program.

[Detailed Explanation of this Invention]

[0001] [Field of the Invention]

The present invention relates to a method that quickly searches programs corresponding to the viewer preference from numerous broadcast programs transmitted via a digital TV broadcasting systems and displays the searched programs.

[0002] [Discussion of the Prior Art]

In recent years, a large number of programs are provided by the digital television systems through numerous television broadcast channels. This digital television system allows a large number of programs to be transmitted through more than 100 channels via satellite broadcasting systems. Therefore, it is very cumbersome to search preferred programs from a TV program table printed on newspaper, TV program guidebook, and the like. Currently, the digital TV broadcasting utilizes the system conforming the DVB standard (Digital Video Broadcasting) established in Europe. With this DVB standard, in addition to the image and voice data of the

broadcasted program, SI (Service Information) data is transmitted. Using this SI data, EPG (Electronic Program Guide = program guide displayed on the TV screen) data can be prepared by the TV receiver /3 for selecting the stations for preferred programs.

[0003] However, since the TV screen having a limited display area cannot display the entire broadcasted program guides provided by this EPG data, a certain number of program data are displayed and sequentially scrolled, or program data are displayed according to the categories of broadcasted programs (e.g., news, movie, music, sports, theater play, etc.) included in the SI data. Those displayed data are manipulated using the station selection input means provided to the TV receiver for searching preferred programs.

[0004] [Problems to Be Solved by the Present Invention]

With a digital TV system performing multi channel broadcasting, the SI data accompanying the program data is used to create the EPG display for searching/selecting preferred programs from the EPG program guide shown on the screen of TV receiver that receives/reproduces digital TV signals. As this SI data comprises characters and numeral data, the EPG display also consists of characters and numbers. Therefore, a viewer selects the station and program by reading the program information displayed as characters and numbers. In this case, if the selected program is not selectable to the viewer, another program and station must be searched again

from the EPG display, resulting in cumbersome process when searching stations and programs.

[0005] The object of the present invention is to provide a program search display device that displays program information matching the viewer preference with a capacity to simultaneously displaying the image content of the program so that the viewer can easily grasp the program content.

[0006] [Method to Solve the Problems]

To achieve the object described above, the present invention provides a program search display device of a TV receiver that receives and plays back TV signals being transmitted as superimposed signals carrying service information of TV programs, comprising (1) a service information storing means that isolates/stores the service information attached to said TV programs, (2) viewing priority sequence storing means that establishes/stores the viewer preference and viewing priority order of said TV programs, (3) viewing program data storing means that compares and matches the service information stored in the service information storing means, viewer's preference stored in the viewing priority sequence storing means, and viewing priority sequence and stores the image data of the TV programs conforming the viewing preference and viewing priority order in addition to the service information, (3) window size creation means that creates different sizes of program guide windows according to the image data and service information of TV programs stored in the



viewing program data memory means, (4) program window display means that displays plural program guide windows comprising different display sizes created by the window size creation means onto the TV receiver screen, and (5) program selection means that selects a program from plural program guide windows displayed by the program window display means.

[0007] [Embodiment of the Present Invention]

The following explains the embodiment of the present invention with reference to the drawings. Fig. 1 is a circuit configuration diagram showing one example of the digital television receiver of the present invention.

[0008] In the figure, reference numeral **11** denotes an antenna receiving digital TV signals transmitted from a broadcast satellite; reference numeral **12** denotes a digital signal setup box for reproducing the digital TV signals; reference numeral **13** denotes an analog TV receiver that reproduces and displays TV signals that have been reproduced by said digital signal setup box **12** and converted to analog signals; and reference numeral **14** denotes a video recorder that records TV signals that have reproduced by the digital signal setup box and converted to analog signals.

[0009] Said digital signal setup box **12** is roughly divided into a digital signal production part **15** and microcomputer part **16** for controlling this digital signal reproduction part **15** (hereinafter,

the term "microcomputer control part" is used to specify this device).

[0010] Said digital signal reproduction part 15 comprises a tuner 21 connected to said antenna 11, QPSK demodulator 22 connected to said tuner 21, error corrector 23 connected to said QPSK demodulator 22, descrambler 24 connected to said error collector 23, packet separator 25 connected to said descrambler 24, packet separation memory 26 and MPEG decoder 27 connected to said packet separator 25, MPEG memory 28 connected to said MPEG decoder 27, video signal digital/analog converter (hereinafter, the term "video D/A" is used to specify this part) 29 and audio signal digital/analog converter (hereinafter, the term "audio D/A" is used) 30, and display controller 31 connected between said MPEG decoder 27 and video D/A 29.

[0011] Said microcomputer control part 16 comprises a tuner 21 of said digital signal creation part 15, QPSK demodulator 22, error corrector 23, descrambler 24, packet separator 25, bus line 32 connected to the MPEG decoder 27 and display controller 31, first -  $n^{\text{th}}$  work memories 35a - 35n, first -  $n^{\text{th}}$  data memories 36a - 36n, Kanji (Japanese characters) ROM 37, I/O controller 38, remote control-display panel (hereinafter, the term "remote control-display panel" is used to specify this part) connected to the IC card controller 39, modem 40, and said I/O controller 38, and telephone line 42 connected to the modem 40.

[0012] The devices constituting said digital signal reproduction part 15 are operated in the same way as the conventional regular devices, and therefore, the explanations are omitted. The digital TV signal received by the antenna 11 and converted to a middle frequency is supplied to said tuner 21 so as to select the station preferred by the viewer and converted to a base band signal. This base band signal is demodulated into digital data by the QPSK demodulator and /4 supplied to the error collector 23. This error collector 23 detects/corrects errors of the digital data while divides the demodulated digital data into packets and supplies them to the descrambler 24 as transported stream data. This descrambler 24 cryptoanalyzes the signals when the transmitted signals are encrypted, recovering the original signals, providing them to the packet separator 25. This packet separator 25 separates the image data, voice data of the program and various kinds of information data attached to the program from each packet data according to the packet separation sequence stored in the packet separation memory 26. Each packet data separated by said packet separator 25 is supplied to the MPEG decoder 27. This MPEG decoder 27 is decoded according to the method stored in the MPEG memory 28. The MPEG-decoded signals are converted from digital signals to analog signals by the video D/A 29 to provide image signals and by the audio D/A 30 to provide audio signals. Then, those processed signals are outputted to the analog TV receiver 13 and analog video recorder 14. The image signal

decoded by said MPEG decoder 27 is controlled/outputted to the video D/A as an image output by the display controller 31 according to the display format conforming the inputted request of the viewer. As a practical example, for displaying the EPG on the screen of analog TV receiver, the program data separated from the SI data, which is the data added to the digital TV signals, may be displayed along with the EPG display format by the display controller 31, or the SI data associated with the program may be displayed after being overlaid to the image signals of the program.

[0013] The microcomputer control part 16 efficiently processes the digital signal reproduction part 15 via the bus line 32 according to the real-time OS mounted onto the CPU 33 and processing sequence stored in the program memory 34 while providing the EPG-display required by the viewer and displaying the program image. The first -  $n^{\text{th}}$  work memories 35a - 35n in this microcomputer control part 16 stores the creation sequence of display format for each display format of the image displayed on the screen of the analog TV receiver 13. The first -  $n^{\text{th}}$  data memories 36a - 36n are the memories storing the data corresponding to the display format. A Kanji (Japanese characters) ROM 37 contains stored character data used to create characters and numbers displayable on the TV screen from the SI data attached to the program data included along with the program image of the digital TV signals and voice signals. The I/O controller 38 is a remote controlled input means of the remote controller display panel

41, having a function of transmitting the input data inputted by the viewer to the microcomputer control part or supplying the output for controlling the motion display panel provided to the digital signal setup box 12. Furthermore, If the program received via the antenna 11 and selected by the tuner 12 is encrypted, the viewer number or cryptoanalyzing key stored on an IC card 39a are read by an IC card controller 39 and matched with the cryptoanalyzing permission conditions in the transmitted signal while the cryptoanalyzing key is supplied to the descrambler 24. The modem 40 is for transmitting the usage fee information to the broadcast program supplier via a phone line 42 when a fee-based broadcasting service is selected.

[0014] With the digital signal setup box 12 configured and operated as explained above, in order to create the EPG from the SI data added to each TV program, if the SI data and EPG creation sequence have been stored in the first work memory 35, when a viewer selects an EPG display option from the remote controlled display panel 41, the CPU 33 follows the sequence stored in the work memory 35a and controls the digital signal reproduction part 15 to read the SI data superposed and transmitted to each broadcast channel, stores the data to the first data memory 36a, and displays the data to the analog TV receiver 13 via the MPEG decoder 27 and display controller 31 using the character data obtained from the Kanji ROM 37 based on the data stored in the first data memory 36a.

[0015] The program preferences are widely varied among viewers depending on the ages, sexes, characters, and tastes. Therefore, it is time-consuming when searching preferable programs from the EPG that displays the broadcast signals of more than 100 channels and various programs within the broadcast time. For this reason, the sequence for inputting the viewer's age, sex, hobby, and taste is pre-stored in the second work memory 35b. For example, questions are displayed on the analog TV receiver screen 13 to allow a viewer to select (click) the applicable item of each question by operating a remote controller or input means. Particularly, preference and taste columns are designed to allow a viewer to input his preference according to the program categories or genre; for example, the movie column has input options over domestic movies, foreign movies, modern movies, classic movies, romantic movies, musical movies, and produced country names for foreign films, while sports column has input options over the sport types, domestic or foreign sports, professional or amateur sports, etc. The viewing preference data of the viewer is stored in the second data memory 36b based on the viewer's preference/taste inputs stored in the second work memory 35b.

[0016] Next, when an applicable input is entered from the remote controlled display panel 41, the SI data of each channel stored in the first data memory 36a and viewer's preference data stored in the second data memory 36b are compared and matched according to the

processing sequence stored in the third work memory 35c to extract the SI data suitable for the viewer's preference, stored in the third data memory 36c, and displayed on the screen. As a result, since only the programs matching the preference of the viewer can be displayed, searching a program or selecting a station can be easier. Furthermore, by adding priority sequence to this preference, the viewer can select the station more easily. In addition, if the stations/programs selected by the viewer in the past are stored in the second data memory 36b, the range of selectable data of the preferable programs can be widened along with the preference data inputted by the viewer. The SI data matching the viewer's preference is organized as shown in Fig. 2 and stored in the third data memory 36c. /5

[0017] Part (a) of Fig. 2 shows the data structure organized according to the program categories (hereinafter, the term "viewing priority order" is used). Part (b) in the figure shows the data structure organized in the order of viewing priority order of the sports program category, whereas Part (c) shows the data structure organized in the order of viewing priority order of the movie programs in the movie program category.

[0018] When displaying this type of program category viewing order data, the channel number, channel name, program name, program date/time, starting time/ending time, and the like are conventionally displayed in the order of said viewing order sequence of the present

time period according to the display format, wherein the table format is most widely used as the display format.

[0019] However, the table display format designed to provide the program contents by the program names cannot provide sufficient content information, particularly for programs such as plays and movies. Therefore, the present invention provides an EPG display that allows viewers to obtain sufficient program contents.

[0020] The following explains the practical example of the present invention while referring to a screen display example of a TV receiver shown in Fig. 3. In the figure, reference numeral 50 denotes a TV screen. Five program category areas V, W, X, Y, and Z are allocated in this TV screen 50 using the boundary lines V', W', X', Y' and Z'.

[0021] The program 51 having the highest priority in the category (e.g., Professional baseball in the Sports category) is displayed at the center of the TV screen 50. For the area V, which is the upper left area of the center display 51 in the screen, program names are displayed from the outer edge area toward the center of the screen in the order of descending priority order, wherein each displayed name size is also sequentially reduced in the order of descending priority order. That is, the program guide window 52 having the second viewing priority is displayed at the upper left in the area V, and program guide window 53 having the third viewing priority is displayed below the program guide window 52 toward the



center of the screen, below which the program guide window 52 having the fourth viewing priority is displayed closer to the center of the screen. The display area of the program guide window 51 having the highest viewing priority is the largest program guide window in the screen, wherein the display content comprises the channel number 51a, channel name 51b, program name 51c, program starting date/time and ending date/time 51d and image of the program 52. Next, the program guide window 52 having the second viewing priority is displayed as a window smaller than the center display 51, containing the same information items as in the display 51. The program guide windows 53 and 54 respectively having the third priority and fourth priority are displayed with the same information items with the display sizes sequentially reduced according to the priority levels, wherein the program guide window area having the third priority is approx. a half of the size of the program guide window 52 having the second priority, and the program guide window 54 having the fourth priority is approx. a half of the size of the program guide window 53 having the third priority.

[0022] The display areas W, X are displaying, for example, the movie category, wherein the program guide windows 55 and 56 respectively showing the domestic film having the highest viewing priority and domestic film having the second highest viewing priority are displayed in the area W, while the program guide windows 57 and 58 respectively display the foreign film having the highest viewing

priority and foreign film having the second highest viewing priority in the area X. As for the display area allocated to each of those program guide windows 55 - 59, assuming that the foreign movie 57 is ranked as the highest priority, domestic movie 55 is ranked as the second highest, and the rest of movie displays are ranked in the order of 58, 56, and 59, the sizes of those program guide window areas are sequentially lessened in the descending order from the highest ranked program guide window 57, while boundary lines X1, X2 are provided for dividing said priority order for easier recognition of the program priority sequence.

[0023] In addition, program categories are established to other display areas Y, Z, and programs of respective category are displayed according to the viewing priority order in the appropriate area.

[0024] For example, to select a station for the program guide window 51 having the highest viewing priority in the EPG display designed in this display format, after the selection cursor in the TV screen 50 is dragged to the program guide window 51 using the remote controller input means of the remote controlled display panel 41 of the digital signal setup box 12, the viewer clicks the selection button to select the program station indicated in the program guide window 51. As a result, the EPG display is erased, switching the TV screen display to the program indicated by the program guide window 51. If the viewer decides not to select this program based on the display content in the program guide window 51 and the image 51e of

the highest viewing priority and decides to select another program, after dragging the cursor to the program guide window 52 having the second highest viewing priority, the viewer selects the option to enlarge the program guide window 52. Then, the program guide window 51 having the highest viewing priority is erased, allowing the program guide window 52 having the second highest viewing priority to be enlarged and displayed at the area where the program guide window 51 had been displayed. As a result, the rest of the program guide windows are respectively sequentially shifted to the areas previously displaying the programs having one level higher viewing priority (i.e., program guide window 53 having the third highest priority is appropriately enlarged and displayed at the area previously the program guide window 52 having the second highest priority was shown; program guide window 54 having the fourth highest priority is appropriately enlarged and displayed at the area previously showing the program guide window 53 having the second priority; and new program guide window having the fourth priority, not previously displayed in the TV screen, is displayed at the area previously showing the program guide window 54 having the fourth priority). To select the station for the foreign movies displayed in the area X, the program guide window having the first foreign film viewing priority may be shifted to the location where the program guide window 51 for showing the program having the highest priority, or, program guide window 58 having the second foreign movie priority may

be enlarged and transferred to the location where the program guide window having the highest foreign movie priority 57 had been displayed.

[0025] By providing this display configuration, program contents can be searched from the plural program guide windows shown in the TV screen 50 in the sequence from the highest prioritized program to the lowest prioritized program. Also, at the time of searching the program, the currently selected program guide window showing the program content is enlarged with the program image, thereby allowing a viewer to easily comprehend the program content. Furthermore, program guide windows are arranged in the order of viewing priority with the display sizes reflecting the priority levels, and the smaller program guide windows positioned far from center are sequentially moved toward the center of the screen with increased display sizes as program search progresses, thus being able to provide a three-dimensional visual effect by moving and switching the sizes of the program guide windows. /6

[0026] This TV screen program guide window also simultaneously includes the images of the applicable programs being added to the SI data accompanying the TV program. To provide this image display, for example, the program image data for each channel is read by following the processing sequence pre-stored in the fourth work memory 35d, while obtaining the program image data stored in the fourth data memory 36d as a still image data. The still image data stored in the

fourth data memory 36d and SI data matching the viewer preference stored in the data memory 36c are superposed and displayed on the TV screen 50 in the order of viewing preference. Also, by changing the image data of each program written onto the fourth data memory 36d at a certain interval, the image of each program guide window shown on the TV screen 50 can provide intermittent image movements while being able to display the currently broadcasted image, thereby being able to offer information effective for program selection.

[0027] The display controller 31 of the digital signal setup box 12 sets the image display format and display area shown on the TV screen 50, wherein said display controller 31 can be formed by utilizing a logic circuit shown in Fig. 4.

[0028] Reference numeral 61 in Fig. 4 denotes an input terminal to which image data that has been decoded by the MPEG decoder 27. The image data supplied to the input terminal 61 is stored in the memory 62. On the other hand, the output from the horizontal counter 63 operated by the horizontal clock signal corresponding to the horizontal synchronous signal transmitted from the horizontal synchronous driver (not shown in the figure) of the digital signal setup box 12 or analog TV receiver 14 is supplied to one of the input terminal of the horizontal comparator 64, while the output from the horizontal reading initial value circuit 65 in the memory 62 is supplied to the other input terminal of the horizontal comparator 64. When the clock of the horizontal counter 63 and positional signal

transmitted from the horizontal reading initial value circuit 65 become identical, the horizontal reading signal outputted from the horizontal comparator 64 is supplied to one of the input terminal of the horizontal AND circuit 66 as well as to the horizontal size counter 67, one of the input terminals of the vertical NAND circuit 74, horizontal reduction circuit 79, and vertical reduction circuit 79. The output from the horizontal AND circuit 66 is supplied to the memory 62 as an image data read-reset signal. The output from the horizontal size counter 67 is supplied to one of input terminals of the comparator 68, while a size signal outputted from the horizontal size signal creator 69 is supplied to the other input terminal of the comparator 68. Furthermore, the output from this comparator 68 is supplied to one of input terminals of the AND circuit 70 and horizontal size counter 67. The output from this AND circuit 70 is supplied as an enabling signal of the memory 62.

[0029] Next, the output from the vertical counter 71 operated by the vertical clock signal corresponding to the vertical synchronous signal transmitted from the vertical synchronous driver (not shown in the figure) of the digital signal setup box 12 or analog TV receiver 13 is supplied to one of input terminals of the vertical comparator 72, while the output from the vertical read-initial value circuit 73 of the memory 62 is supplied to the other input terminal of the vertical comparator 72. When clock of the vertical counter 71 and the signal outputted from the vertical read-initial value circuit 73

become identical at the vertical comparator 72, a vertical read signal is supplied to the vertical size counter 75. The output of this vertical comparator 72 is supplied to one of input terminals of the horizontal AND circuit 66 and vertical reduction circuit 79. The output from this vertical comparator 72 is connected to the other input terminal of the horizontal AND circuit 66 and vertical reduction circuit 79. Also, the output from the vertical NAND circuit 74 is connected to the other input terminal of the vertical size counter 75 while the output terminal of the vertical size counter 75 is connected to the input terminal of one of input terminals of the comparator 76. The vertical size signal creator 77 is connected to the other input terminal of the comparator 76, while the output terminal of the comparator 76 is connected to the AND circuit 70 and the other input terminal of the vertical NAND circuit 74. The outputs from the horizontal reduction circuit 78 and vertical reduction circuit 79 are connected to the respective input terminals of the AND circuit 80. The output from the memory 62 is connected to the buffer memory 81, wherein the output from the AND circuits 66, 80 are connected to the buffer memory 81, so that, when the horizontal AND circuit 66 is outputted, the data writing from the memory is reset, while the output from the AND circuit 80 is used to enable data writing to the buffer memory 81.

[0030] The output from the horizontal AND circuit is also connected to the horizontal counter 82, while the output from this

horizontal counter is connected to one of input terminals of the comparator 83. The output from the counter 84 is connected to the other input terminal of the comparator, while the horizontal read-initial position initial value circuit 85 is connected to the input terminal of the comparator 84. The output from the vertical comparator 72 is connected to the vertical counter 86, wherein the output from this vertical counter 86 is connected to one of the input terminals of the comparator 87, while the output from the counter 88 is connected to the other input terminal of the comparator 87. Also, the vertical read start position initial circuit 89 is connected to the input side of this counter 88. The output from the comparator 83 is connected to one of input terminals of the AND circuit 90, while the output of the comparator 87 is connected to the other input terminal of the AND circuit 90. The output from this AND circuit 90 supplies the initial value reset signal at the image data reading start position stored in the buffer memory 81. Furthermore, the output from the comparator 83 is connected to one of input terminal of the RSF/F circuit 91 and counter 95. Also, the counter 92 and horizontal reading size initial value circuit 93 are serially connected to the other input terminal of the RSF/F circuit 91. The output from the comparator 87 is connected to the other input terminal of the AND circuit 90 and also to one of input terminals of the RSF/F circuit 94. In addition, the counter 95 and vertical read-out size natal value circuit 96 are serially connected to the other



input terminal of the RSF/F circuit. The output from the RSF/F /7  
circuits 91, 94 are respectively connected to the input terminals of  
the AND circuit 97, while the output from the AND circuit 97 is  
supplied to the buffer memory 81 as an enabling signal for each read-  
out image data size. The output from the buffer memory 81 is  
supplied to the video D/A 29 of the digital signal setup box 12 from  
the output terminal 98.

[0031] With the logical circuit configured as explained above,  
horizontal/vertical read initiation value reset signals are created  
using the horizontal counter 63/ horizontal read start value circuit  
65 and vertical counter 71/vertical read start value circuit 73.  
Then, the image data read-out start position stored in the memory 62  
is reset, and the AND circuit 70 creates a horizontal/vertical read-  
out period enabling signal from the size data provided by the  
horizontal size signal creator 69 and vertical size signal creator  
77. Next, the image data in the memory 62 is transferred to the  
buffer memory 81. After this buffer memory 81 resets the image data  
transferred from the memory 62 and during the write enable signal  
period, the image signal image signals are written to the buffer  
memory during the write-enabled period created by the horizontal  
reduction circuit 78 and vertical reduction circuit 79 and outputted  
by the AND circuit 80. The image signal written to the buffer memory  
81 is created by the horizontal counter 82 and horizontal read start  
position initial value circuit 85 as well as by the vertical counter

86 and vertical read start position initial value circuit 89. Then, the read position reset signal transmitted from the AND circuit 90 is used to reset the image data read position of the buffer memory 81. Next, after the horizontal/vertical size initial value circuits 93, 96 create the data, the image data is read during the period while the AND circuit 97 is issuing the read-enable signal and supplied to the video D/A 29 from the output terminal 98.

[0032] That is, the size of image data to be transferred to the buffer memory 81 is set by the horizontal size counter 67 and vertical size counter 75 for the image data sent to the memory from the input terminal 61. In other words, the image and SI data displayed as the EPG in the highest viewing priority program guide window explained by referencing to Fig. 3 (e.g., program guide window 51 in Fig. 3) are transferred from the memory 62 to the buffer memory 81 and stored.

[0033] When transferring/storing the data to the buffer memory 81 from the memory 62, the horizontal/vertical reduction ratios are established for each program guide window size by the horizontal/vertical reduction circuits 78, 79, and the data is read from the memory 62 and stored to the buffer memory 81 for an amount corresponding to the reduction ratios. That is, if the display size of the program guide window 52 in Fig. 3 is a half of the size of the program guide window 51, for example, the horizontal/vertical reduction circuits 78, 79 appropriately reduce the size in the

horizontal and vertical directions when reading and storing the image and SI data for the program guide window 52.

[0034] This size reduction operation is explained below by referencing to Fig. 5. Assuming that the image and SI data stored in the memory 62 comprises the data in every square in the axes of abscissa and ordinates, the data existing in every other square in both the horizontal and vertical directions (W11 - W77 in the figure) are read and stored in the buffer memory 81. Note that Fig. 6 shows an example of operation when the data is reduced to 1/3 in both the vertical and horizontal directions, wherein the sections W11 - W45 in the figure denote the data read and stored in the buffer memory 81.

[0035] Next, the data read and stored in the buffer memory 61 is read according to the data read-out start position signal set by the horizontal/vertical read-out start position initial value circuits 85, 89 and data read-out period signal set by the horizontal/vertical read-out size initial value circuits 93, 96 [see Part (b) of Fig. 5 and Part (b) of Fig. 6]. As a result, in the case of Part (b) of Fig. 5, a half of the data stored in the memory 62 is outputted to the output terminal 98, while in the case of Part (b) of Fig. 6, one third of the data stored in the memory 62 is outputted to the output terminal.

[0036] By reducing the program guide window data to be displayed on the TV screen 50 according to the display size in this manner, the program guide window size reflecting the viewing priority of the

program can be established. Also, by making the reduction ratio as a variable for each program data, the program guide window size can be changeable.

[0037] The counters 84, 88 connected to the horizontal and vertical read-out position initial value circuits 85, 89 function to change the display location of each program guide window to be re-displayed on the TV screen 50. Also, counters 92, 95 connected to the horizontal/vertical read-out size initial value circuits 93, 96 function to change the display size of each program guide window. That is, as previously explained by referencing to Fig. 3, when the program guide window 52 having the second viewing priority is selected instead of the program guide window 51 having the highest priority, after the program guide window 51 is erased, the program guide window 52 is enlarged and transferred to the location where the program guide window 51 existed. The counters 84, 88, 92, and 95 are used to provide those changes of program guide window location and display size.

[0038] The following explains another preferred embodiment of the present invention. Programs listed in the newspapers and TV program magazines can be edited by the CDV-ROM and DVD-ROM, to which main program image data of the program can be added. The following explains a method of displaying and searching a program based on the program image data using the CDV-ROM or DVD-ROM (hereinafter, the term "program medium" is used.)

/8

[0039] The data reading sequence recorded in the program medium is stored in the  $n^{\text{th}}$  work memory 35n of the digital signal setup box 12 beforehand, and the  $n^{\text{th}}$  data memory 36n is set as the program medium. Based on the sequence stored in the  $n^{\text{th}}$  work memory 35n, the program data is read from the program medium of the  $n^{\text{th}}$  data memory 36n and compared with the preference data of the viewer stored in the third work memory 35c. By storing the comparison result to the third memory 36c, program guide windows stored in the program medium in the sequence of program categories and viewing priority sequence can be displayed on the TV screen 50.

[0040] Also, since a week - several weeks of program data can be recorded in the program medium, a program station can be pre-selected according to the program starting date/time and recorded.

[0041] Although the digital signal setup box receiving and playing back the digital TV signal was described as an apparatus separate from the TV receiver that reproduces and displays the TV image, voice, and SI data in the example described above, the TV receiver may be configured to have an integrated digital signal setup box.

[0042] Also, in the example described above, a program is searched from the plural of program guide windows shown on the TV screen in the order of descending viewing preferences. However, when a viewer decides to retry and search a program having higher viewing priority levels, by inputting a return search option using the search

input means, the currently displayed program guide windows can be moved back to the previous locations as smaller windows, while the programs in the higher priority that had been transferred on the screen as smaller windows can be redisplayed to the original locations and sizes.

[0043] [Effectiveness of this Invention]

With the method of the present invention, by extracting the image data and SI data of programs conforming the viewer preferences and displaying the data on the TV screen, the viewer can easily examine the content of the selected programs from the image data and SI data. In addition, when displaying the extracted image data and SI data of the program to the TV screen, the size of each program guide window is reduced in the descending order of viewing priority, while program guide windows are arranged on the TV screen being scattered or divided into program categories to make the selection of appropriate station for the preferred program easier. Furthermore, for searching the desired program, the program guide windows having lower viewing priority are sequentially enlarged to provide three-dimensional visual effect and game-like enjoyment to the searching programs and station selection process.

[Simple explanation of the figures]

[Figure 1] is a circuit diagram showing an embodiment of the digital TV receiver of the present invention.

[Figure 2] is a diagram showing the process of storing data to the memory.

[Figure 3] is a diagram showing the TV screen display format.

[Figure 4] is a diagram of a logical circuit that creates the TV screen display format.

[Figure 5] is a diagram explaining the process of reducing the program guide window on the TV screen.

[Figure 6] is a diagram explaining the process of reducing the program guide window on the TV screen.

[Explanation of Keys]

11...Antenna; 12...Digital signal setup box; 13...Analog TV receiver;  
14...Video recorder; 15...Digital signal playback part; 16...Controlling  
microcomputer; 21...Tuner; 22...QPSK demodulator; 23...Error corrector;  
24...Descrambler; 25...Packet separator; 26...Packet separation memory;  
27...MPEG decoder; 28...MPEG memory; 29...Video D/A; 30...Audio D/A;  
31...Display controller; 32...Bus line; 33...CPU; 34...Program memory;  
35...Work memory; 36...Data memory; 37...Kanji ROM; 38...I/O controller;  
39...IC card controller; 40...Modem; 41...Remote controlled display panel;  
42...Telephone line

[Figure 1]



[Figure 2]

(a)

Program category priority order	
Priority order	Program category
1	Sports
2	Movies
3	Music
:	
n	N

(b)

Program category: Sports priority order	
Priority order	Program category
1	Prof. Baseball
2	Soccer
3	Golf
:	
n	N

(c)

Program category: Movie priority order	
Priority order	Program category
1	Foreign film: Western
2	Foreign film: Musical
3	Domestic film: Historical drama
:	
n	N

Key 110 Sports channel - Wimbledon final game; 120...Sports channel -  
Golf; 100...Sports channel - Japan Series Game No. 5 (Live); 106...Music;  
102...Foreign film

Video D/A

Key 61...MPEG decoder; 63...H counter; 62...Memory; RRST (n)...Reset; REN  
(n)...Enable; WEN...Interrupt enable; WRST...Reading reset; 65...Memory (n)

read-out start value (horizontal); 67...H size counter; 69...Horizontal size; 71...V counter; 78...Horizontal reduction circuit; 79...Vertical reduction circuit; 73...Memory (n) read-out starting value (vertical); 75...V size counter; 77...Vertical size; 81...Buffer memory (time axis conversion); 82...H counter; 84...Counter; 85...Read-out start position initial value (horizontal); 86...V counter; 88...Counter; 89... Read-out start position initial value (vertical); 92...Counter; 93...Read-out size initial value (horizontal); 95...Counter; 96...Read-out size initial value (vertical)

/11

Memory

Buffer memory

(Horizontal/vertical 1/2 skipping)

Memory

Buffer memory

(a)

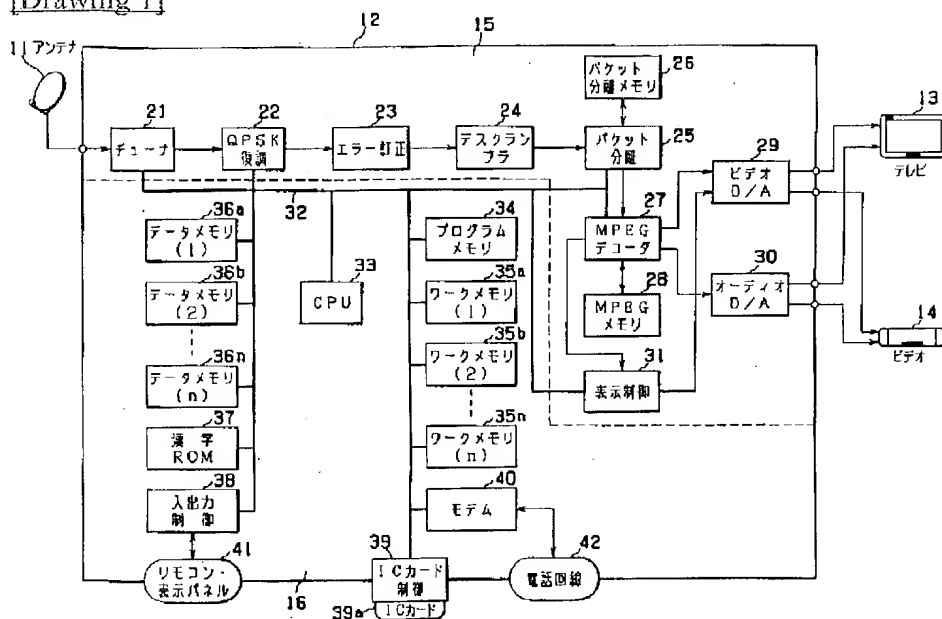
## \* NOTICES \*

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

## DRAWINGS

[Drawing 1]



[Drawing 2]

(a)

番組カテゴリー優先順位	
優先順位	番組カテゴリー
1	スポーツ
2	映画
3	音楽
⋮	
n	N

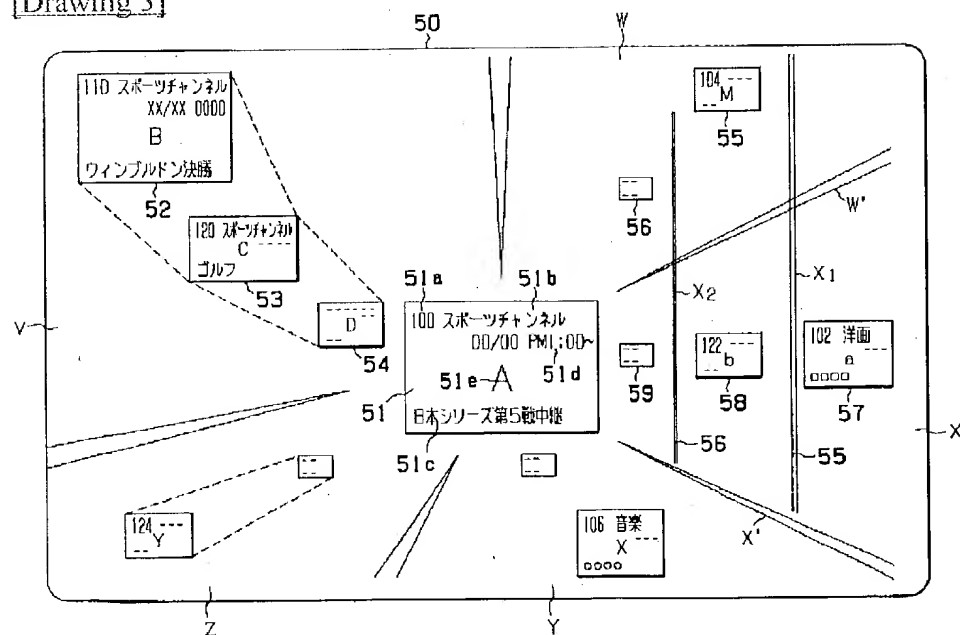
(b)

番組カテゴリー：スポーツ優先順位	
優先順位	番組名
1	プロ野球
2	サッカー
3	ゴルフ
⋮	
n	N

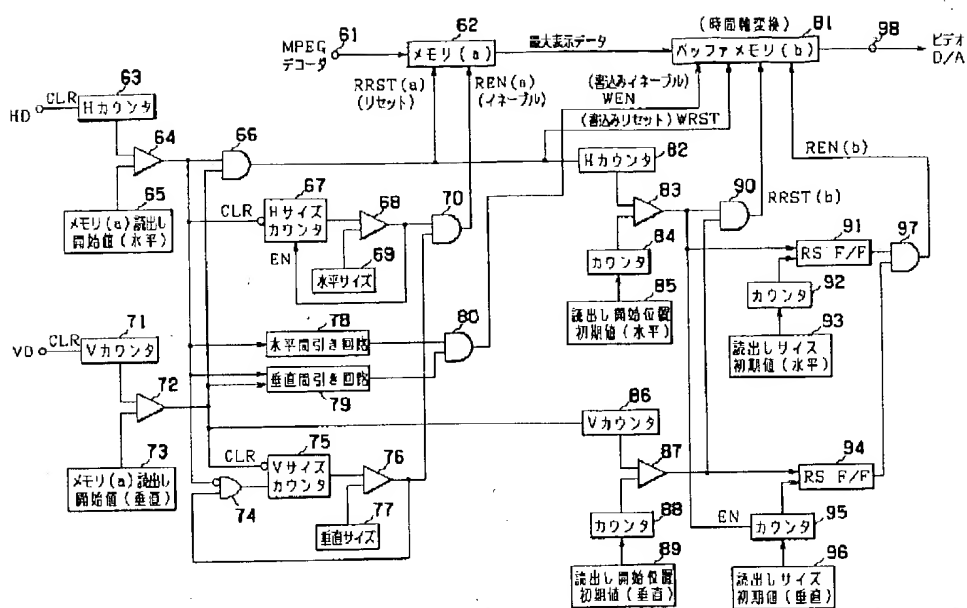
(c)

番組カテゴリー：映画優先順位	
優先順位	番組名
1	洋画 西部劇
2	洋画 ミュージカル
3	邦画 時代劇
⋮	
n	N

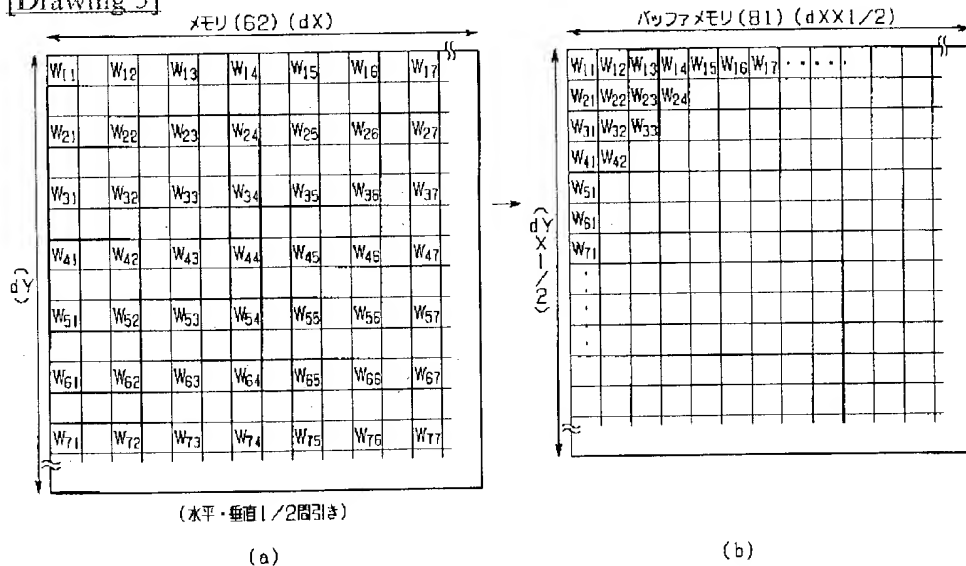
[Drawing 3]



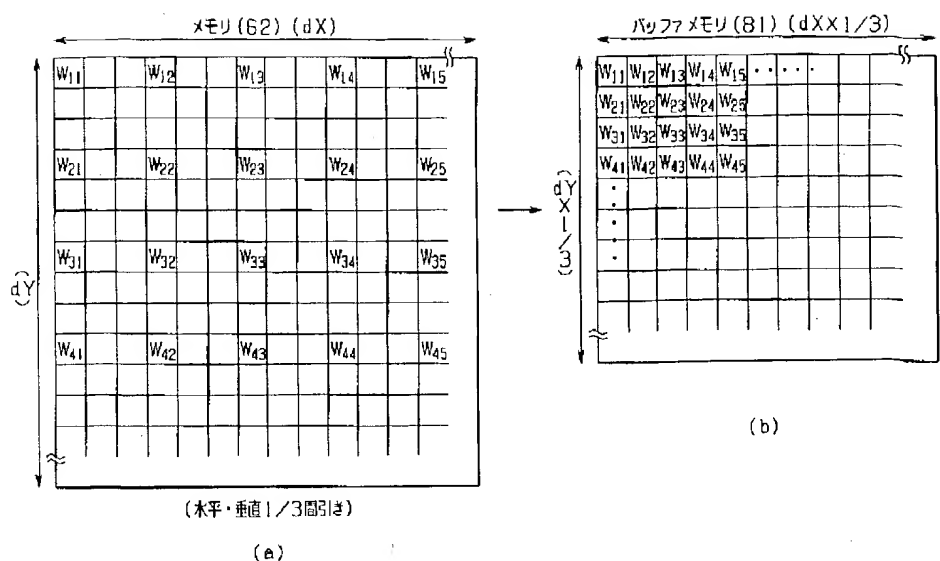
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Translation done.]